

CLAIMS

We claim:

- a) 1 1. A programmable logic device comprising:
 - a) 2 volatile memory adapted to configure the programmable logic device for its intended function based on configuration data stored by the volatile memory;
 - a) 5 non-volatile memory adapted to store data which is transferable to the volatile memory to configure the programmable logic device;
 - a) 8 a first data port adapted to receive external data for transfer into either the volatile memory or the non-volatile memory; and
 -) 11 a second data port adapted to receive external data for transfer into either the volatile memory or the non-volatile memory.
- a) 1 2. The programmable logic device of Claim 1, further comprising control logic adapted to transfer the data from the non-volatile memory to the volatile memory to configure the programmable logic device.
- a) 1 3. The programmable logic device of Claim 1, further comprising core logic adapted to be configured by the configuration data stored in the volatile memory.

a) 1 4. The programmable logic device of Claim 1, wherein the
a) 2 volatile memory comprises static random access memory and the
a) 3 non-volatile memory comprises flash memory.

a) 1 5. The programmable logic device of Claim 1, wherein the
a) 2 non-volatile memory is further adapted to store security bits
a) 3 that can be set to prevent unauthorized reading of the data from
a) 4 the programmable logic device.

a) 1 6. The programmable logic device of Claim 1, wherein the
a) 2 first data port is a JTAG port and the second data port is a CPU
a) 3 port.

a) 1 7. The programmable logic device of Claim 6, wherein the
a) 2 first data port supports an IEEE 1149.1 standard, with the
a) 3 external data transferred to the non-volatile memory and/or the
a) 4 volatile memory via an IEEE 1532 programming mode or to the non-
a) 5 volatile memory via a background programming mode.

a) 1 8. The programmable logic device of Claim 6, wherein the
a) 2 external data is transferred through the second data port to the
a) 3 volatile memory via a system configuration mode, to the non-
a) 4 volatile memory directly, and/or to the non-volatile memory via
a) 5 a background programming mode.

a) 1 9. The programmable logic device of Claim 1, wherein the
a) 2 programmable logic device further supports reading back of the
a) 3 configuration data stored in the volatile memory and/or the data
a) 4 stored in the non-volatile memory for verification.

a) 1 10. The programmable logic device of Claim 9, wherein the
a) 2 programmable logic device further supports the reading back
a) 3 while the programmable logic device performs its intended
a) 4 function based on the configuration data stored by the volatile
a) 5 memory.

a) 1 11. The programmable logic device of Claim 1, wherein the
a) 2 programmable logic device supports transfer of the external data
a) 3 to the non-volatile memory while the programmable logic device
a) 4 is operable to perform its intended logic functions.

a) 1 12. A programmable device comprising:

a) 2 static random access memory adapted to configure the
a) 3 programmable device for its intended function based on
a) 4 configuration data stored by the static random access memory;

a) 5 flash memory adapted to store data which is transferable to
a) 6 the static random access memory to configure the programmable
a) 7 device;

a) 8 a JTAG port adapted to receive external data for transfer
a) 9 into either the static random access memory or the flash memory;

) 10 a CPU port adapted to receive external data for transfer
) 11 into either the static random access memory or the flash memory;
) 12 and

) 13 means for transferring the external data received by the
) 14 JTAG port or the CPU port to the static random access memory or
) 15 the flash memory.

a) 1 13. The programmable device of Claim 12, wherein the means
a) 2 comprises:

a) 3 a background mode adapted to transfer the external data
a) 4 from the JTAG port to the flash memory or transfer the external
a) 5 data from the CPU port to the flash memory;

a) 6 a programming mode adapted to transfer the external data
a) 7 from the JTAG port to the flash memory and/or to the static
a) 8 random access memory; and

a) 9 a system configuration mode adapted to transfer the
) 10 external data from the CPU port to the static random access
) 11 memory.

a) 1 14. The programmable device of Claim 13, wherein the
a) 2 background mode and the programming mode are further adapted to
a) 3 support readback of data stored in the flash memory and the
a) 4 static random access memory.

a) 1 15. The programmable device of Claim 13, wherein the JTAG
a) 2 port supports an IEEE 1149.1 standard and the programming mode
a) 3 supports an IEEE 1532 standard.

a) 1 16. The programmable device of Claim 12, further
a) 2 comprising control logic adapted to transfer the data from the
a) 3 flash memory to the static random access memory to configure the
a) 4 programmable device.

a) 1 17. The programmable device of Claim 12, further
a) 2 comprising core logic adapted to be configured by the data
a) 3 stored in the static random access memory.

- a) 1 18. A method of providing programming options for a
- a) 2 programmable device, the method comprising:
- a) 3 providing a background mode for transferring external data
- a) 4 via a first data port or a second data port to non-volatile
- a) 5 memory;
- a) 6 providing a direct mode for transferring the external data
- a) 7 via the second data port to the non-volatile memory; and
- a) 8 providing a system configuration mode for transferring the
- a) 9 external data via the second data port to volatile memory,
-) 10 wherein the volatile memory is adapted to configure the
-) 11 programmable device.

- a) 1 19. The method of Claim 18, wherein the background mode is
- a) 2 further adapted to readback the external data stored in the non-
- a) 3 volatile memory and the volatile memory.

- a) 1 20. The method of Claim 18, wherein the first data port is
- a) 2 adapted to support a JTAG standard and the second data port is
- a) 3 adapted to provide a CPU interface.

- a) 1 21. The method of Claim 18, further comprising providing a
- a) 2 programming mode for transferring the external data via the
- a) 3 first data port to the non-volatile memory or to the volatile
- a) 4 memory.

a) 1 22. The method of Claim 21, wherein the programming mode
a) 2 is further adapted to readback the external data stored in the
a) 3 non-volatile memory and the volatile memory

a) 1 23. The method of Claim 21, wherein the programming mode
a) 2 is further adapted to support an IEEE 1532 standard.

a) 1 24. The method of Claim 18, further comprising providing a
a) 2 transfer mode for transferring the external data stored in the
a) 3 non-volatile memory to the volatile memory.

a) 1 25. A programmable logic device comprising:
a) 2 volatile memory adapted to configure the programmable logic
a) 3 device for its intended function based on configuration data
a) 4 stored by the volatile memory;
a) 5 non-volatile memory adapted to store data which is
a) 6 transferable to the volatile memory to configure the
a) 7 programmable logic device; and
a) 8 a CPU port adapted to receive external data for transfer
a) 9 into either the volatile memory or the non-volatile memory.

a) 1 26. The programmable logic device of Claim 25, wherein the
a) 2 volatile memory comprises static random access memory and the
a) 3 non-volatile memory comprises flash memory.

a) 1 27. The programmable logic device of Claim 25, wherein the
a) 2 programmable logic device supports transfer of the external data
a) 3 through the CPU port to the non-volatile memory while the
a) 4 programmable logic device is operable to perform its intended
a) 5 logic functions.

a) 1 28. The programmable logic device of Claim 25, further
a) 2 comprising a JTAG port adapted to receive external data for
a) 3 transfer into either the volatile memory or the non-volatile
a) 4 memory.

a) 1 29. The programmable logic device of Claim 28, wherein the
a) 2 data stored in the volatile memory is transferable directly to
a) 3 the non-volatile memory.

a) 1 30. The programmable logic device of Claim 28, wherein the
a) 2 data stored in either the volatile memory or the non-volatile
a) 3 memory is transferable out of the programmable logic device via
a) 4 the CPU port or the JTAG port and transferable into the non-
a) 5 volatile memory or the volatile memory via the JTAG port or the
a) 6 CPU port, respectively, to complete a cross port transfer of the
a) 7 data.

- a) 1 31. A method of providing data transfer options for a
- a) 2 programmable logic device, the method comprising:
 - a) 3 providing a CPU port adapted to receive external data for
 - a) 4 transfer into either volatile memory or non-volatile memory of
 - a) 5 the programmable logic device, wherein data stored in the
 - a) 6 volatile memory configures the programmable logic device; and
 - a) 7 providing data registers adapted to transfer data stored in
 - a) 8 the non-volatile memory to the volatile memory and to transfer
 - a) 9 data stored in the volatile memory to the non-volatile memory.
- a) 1 32. The method of Claim 31, wherein the volatile memory
- a) 2 comprises static random access memory and the non-volatile
- a) 3 memory comprises flash memory.
- a) 1 33. The method of Claim 31, further comprising providing a
- a) 2 JTAG port adapted to receive the external data for transfer into
- a) 3 either the volatile memory or the non-volatile memory of the
- a) 4 programmable logic device.
- a) 1 34. The method of Claim 33, wherein the CPU port and the
- a) 2 JTAG port provide cross port data transfer capability between
- a) 3 the volatile memory and the non-volatile memory.
- a) 1 35. The method of Claim 31, wherein the programmable logic
- a) 2 device supports transfer of the external data through the CPU
- a) 3 port to the non-volatile memory while the programmable logic
- a) 4 device is operable to perform its intended logic functions.